Paper presented in the VI Globelics Conference at Mexico City, September 22-24 2008

Globelics

INNOVATION SYSTEMS AND INEQUALITY: THE EXPERIENCE OF BRAZIL

Maria Clara Couto Soares[1]
José E. Cassiolato[2]

1. Introduction

Inequalities in conditions of generation, access and use of new technologies, systems and content are bringing novel and more complex inequalities between individuals, social groups, organizations, countries and economic blocks, rich and poor. Rather allowing for a better, integrated world where knowledge flows freely, the new world order could be characterized as one where knowledge is assuming more and more a role of a power instrument.

In the same way, the benefits of science and technology to development are neither automatically nor equally distributed among or within countries. Scientific and technological development has created immense capabilities in the current world, which however coexist with growing poverty rates, with hunger and poor health conditions of a significant part of world population. This situation is even worst in highly unequal societies such as Brazil and other Latin American countries.

The effects of purely market-led science and technology efforts and associated innovations tend to aggravate this existing gap unless some alterations are imagined. In spite of representing a significant contribution to the debate on the importance of innovation policies for development, the innovation system approach usually disregards how inequality simultaneous affects and is affected by the national innovation systems.

The main objective of this paper is at analyzing how innovation process can contribute to improve equality in highly unequal societies, taking the example of Brazil. Using as analytical framework the Innovation System approach and the Latin American Structuralism perspective, it proposes that besides current broad recognition of science technology relevance for promoting economic development and competitiveness, it becomes imperative to advance in such debate in order to include their role for fighting inequality and promoting social inclusion.

Palliative interventions designed to and focused on extreme poverty situations that lack a broader systemic approach usually fails to be sustainable in the medium and long term. If the ultimate goal is social inclusion, the approach cannot be restricted to

[1] M.Sc. Economics Institute, Federal University of Rio de Janeiro (IE/UFRJ), Senior Researcher at RedeSist, IE/UFRJ. E-mail: clara@redesist.ie.ufrj.br
[2] Ph.D., SPRU/University of Sussex, professor at Federal University of Rio de Janeiro and coordinator of RedeSist. E-mail:cassio@ie.ufrj.br.

focalized solutions for alleviating poverty or other specific deficits. Improvements due to innovation should also generate a broader dynamic process of societal change, including the generation of local learning processes and capabilities for problem resolution.

Assuming that the emphasis must be put on innovation policies of a broader and systemic character, a hypothesis explored on this paper is that the interactive building of innovation systems targeting social development could contribute to reduce the polarization "modernization – marginalization", which characterizes Brazil, and signaling a less unequal pattern of technological development that could be more consistent with a national long term development project. The broad perspective of the innovation system approach is considered particularly useful to achieve this goal, being and important tool for the design of effective socially oriented innovation policies.

Precisely because socially oriented innovation should be integrated in the broader scope of development trajectories, policies aiming to mobilize the processes of knowledge generation and use are embedded in complexity and cannot be considered de-linked from social, political and economic powers. Therefore, promoting the interlinking between social and innovation policies requires the re-evaluation of development goals and strategic changes are needed to put STI on behalf of social needs. For this aim, priorities need to be reshaped and political will must be constructed to allow the necessary changes. Deepening democratization process and dealing with potential conflicts is another challenge to be faced to foster the entangled process of increasing innovation and equality.

The paper is organized as follows. Item 2 briefly discusses the relevance of technical progress for development, highlighting the particular importance of innovation systems approach for least developed countries. Item 3 concentrates on the discussion of least developed countries specific economic growth and innovation patterns, focusing on Latin American countries. Item 4 analyses some dimensions of the relation between inequality, development and the national innovation system focusing on the case of Brazil. In the last topic the proposal of interlinking social needs and innovation policies from a systemic framework is presented as an alternative aiming a proactive strategy for development with social inclusion.

2. Innovation and Development

2.1 The Relevance of Technical Progress to Development

As stated by Cassiolato & Lastres (2008) "the literature on innovation systems and the theoretical works of the Latin-American structuralism school converge in the sense of ascribing a central role to technology in the development process. Both approaches emphasize that structural changes triggered by technical progress (innovation) is the main determinant of development. According to these perspectives, institutional, organizational, technological and productive changes constitute relevant outcomes of

the innovative process; this latter understood as a core element for a long-term development[3] (pg 3)".

Both streams of thought suggest that the wealth accumulation has its origins in intangible forces such as creativity and knowledge, having its dynamics associated to the incorporation of new technologies and to innovation. From this emphasis on the knowledge accumulation and on growing associated returns, derives the perception about the synergic mechanism that virtuously feed development back within national economies. Additionally, these traditions recall that that the development process is characterized by deep changes in both economic and social structure, mostly associated to technological and/or productive discontinuities experienced by each country.

The recognition of the importance of technological progress as a motor of economic growth, as well as the understanding of the cyclic and long term character of technological change was already present in the contributions of authors as Smith, Marx and Schumpeter[4]. Nevertheless, with the hegemony of the orthodox neoliberal paradigm that prevailed during the 1980s and 90s, the subject lost relevance. The impact of transformations impelled by the advent of information technology and the acceleration of the process of globalization have stimulated to resume the debates on the relation between innovation and development conferring new momentum to the comprehension of their interactions.

Thus, several authors have sought to analyze the dynamics of capitalism through a perspective endogenous to the technical progress. In this perspective, the innovation process, for generating major productive, technological, organizational and institutional changes, is understood as a fundamental instrument of the long term development. The famous work by FREEMAN (1982), highlighting the central role of innovation in the process of development and signalizing its systemic and localized character, constituted a watershed in this debate. It is also in this context that the approach of Innovation Systems is first formulated.

A significant contribution of Latin American structuralist school to the study of the interrelation between technological progress and development was to point out the importance of technological change for understanding the evolution of capitalism, particularly in defining the historical process that frames hierarchies between regions and countries. From a systemic analysis on the development of world capitalism, this school signalizes that the process of radical changes started with the industrial revolution persists until the present days, forming the base of the current structure of world economy.

Such a process of radical changes would have started in those countries with capacity for industrializing and generating technological advances. This pioneering was based, fundamentally, on the accumulation of scientific knowledge and on the capacity for applying such knowledge on the resolution of actual problems, capacities which are

[3] For further details see Cassiolato, E. e Lastres, H. (2008).

[4] For instance, to Schumpeter we owe the connection between technology and the creation of new products, process and the establishment of new markets, as well as the emphasis on the 'disruptive' character of development. These ideas shaped subsequent contributions, among which the unequal distribution of the gains of technological progress between developing and developed countries.

intrinsically connected to the historical conditions of the countries where this development was possible – European countries in the 19th century and USA in the 20th century. The rapid accumulation of capital resulting from this process became the motor of the dynamics of capitalist system, simultaneously originating the international hierarchic system. From this process derives the notion of center and periphery, where the dividing line separating economies consists, fundamentally, of capacity (or not) for absorbing the new technological paradigms and paths.

Another outcome is the contribution on the singularity that characterizes the process of development in a peripheral context. That is, underdevelopment has historical roots and cannot be characterized as an anomaly or else as a preceding stage that shall inexorably evolve towards the developed stage. Such historical roots, as well as the social, economic and political structure of less developed countries, determine a pattern of operation that is peculiar to these countries, directing influencing as much the way how take place the structural changes as the process of incorporation of technological progress.

The Latin-American structuralist school emphasizes, in this context, that the technical progress in less developed countries plays a subordinated role and strengthens the restrictions to innovation that are inherent to the peripheral standing. The hierarchical structure of the world economic system, consequently, reproduces the unequal pattern of generation, use and diffusion of the technological progress, thus constantly feeding back asymmetries between the countries which are in the technological border and the other countries.

The innovation systems approach also signalizes that the capacity for introduction and diffusion of new technologies derives from cumulative trajectories historically built. That is, according to its institutional characteristics and patterns of specialization, each country outlines its specific development path.

From the understanding of the close relation between technological advance and economic growth, both streams of thought emphasize the importance of encouraging innovation as a central part of a development strategy. Especially in the case of less developed countries, the investment in assimilation, adaptation and creation of new technologies and organizational modalities is considered a key element within a strategy for overcoming the subordinated pattern of technological progress.

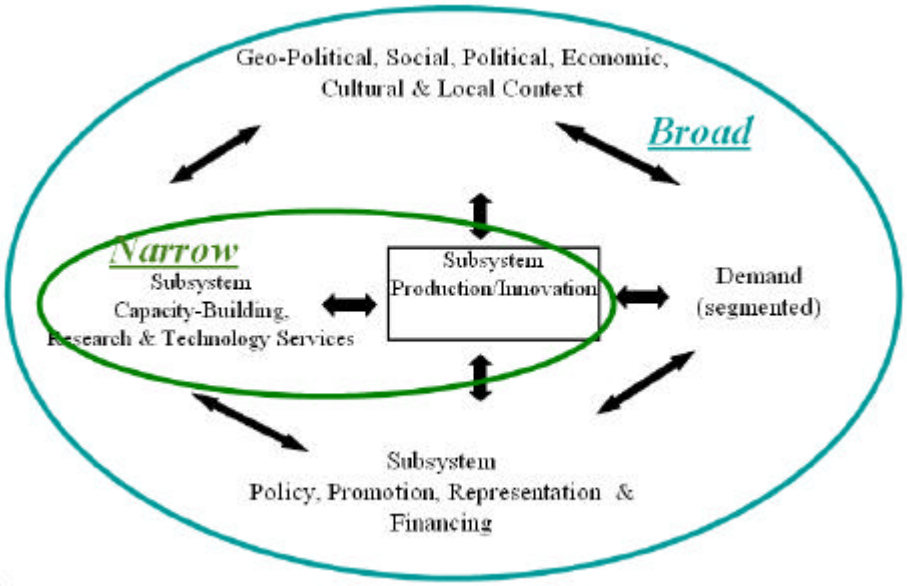
2.2 The Importance of Innovation Systems Perspective for Less Developed Countries

The innovation systems approach has been increasingly applied in different parts of the world for analyzing the processes of acquisition, use and diffusion of innovations and for guiding policy making. Also in Latin America this approach has gained increasing relevance. In this region, its use is occurring through ways connected to the central ideas of the structuralist thought developed in Latin America since the 1950s, under the influence of ECLAC.

Notwithstanding some authors adopting a strict approach of innovation system, whose focus is especially put on efforts of research and development and on organizations

directly connected to science and technology, the broad understanding of innovation system (Freeman 1987, Lundvall, 1985) has a greater analytical and normative capacity. This vision includes, besides the elements considered by the strict approach, the set of governmental policies, financing organizations and all other agents and elements that affect the acquisition, use and diffusion of innovations. It encompasses, thus, as represented in the figure below, different interrelated subsystems, which are affected as much by the context where they are inserted (geopolitical, economic, social, cultural, among others), as by the socio-economic profile of the demand (consumption structure, pattern of income distribution, social organization and demand for social infrastructure).

Figure 1- The Narrow and the Broad Perspectives on National Innovation Systems



As described by Cassiolato & Lastres (2008), *"systems of innovation, defined as a set of different institutions that contribute to the development of the innovation and learning capacity of a country, region, economic sector or locality, comprise a series of elements and relations that relate production, assimilation, use and diffusion of knowledge. In other words, innovative performance depends not only on firms and R&D organizations performance but also on how they interact, among them and other agents, as well as all the other forms by which they acquire, use and diffuse knowledge. Innovation capacity derives, therefore, from the confluence of social, political, institutional, and cultural specific factors and from the environment in which economic agents operate. Different development trajectories contribute to shape systems of innovation with quite diverse characteristics requiring specific policy support.*" (pg 13)

The growing use of the national innovation system approach as an analytical and normative instrument is due to the various contributions brought by it, among which:

i) the perception of innovation as a systemic, non-linear process;

ii) the recognition that incremental and radical, technical and organizational innovations are simultaneous and complementary;

iii) the importance ascribed to history and geography in the design of the development path of each country, emphasizing the localized and specific character of innovation and knowledge, as well as the singularity of national innovation systems;

iv) the understanding that the main elements of knowledge are either incorporated to the agents or inserted in the routines of firms and in the relations between firms and other organizations; what implies that knowledge, for including tacit elements cannot be easily moved from place or context.

v) the importance of taking into account the productive, financial, social, institutional and political contexts, in their micro, meso and macro spheres.

This understanding of the systemic nature of innovation, the emphasis on historical and national trajectories as well as the importance of taking into account different contexts and spheres meant important inputs to less developed countries.

Firstly because including the geopolitical and power relations in the analysis of the process of innovation, learning and knowledge accumulation. Furthermore, insofar it opposes the vision of development as an universal, linear and sequential process, it allows specificities of developing countries to be taken into consideration, thus returning to the agenda the challenge of thinking strategies proper to the specificities of these countries.

It also highlights the localized, specific and socially determined character of the process for generation, adaptation, use and diffusion, calling attention to the relevant question that importing foreign technology is not a substitute for local efforts. That is, irrespectively to the amount of information and knowledge that may be received from abroad, if there will not be a link between the codified knowledge received and internal competences able to translate these knowledge to innovation, no advance will be reached. In this sense, it emphasizes the systemic and interactive character of innovation, also alerting to the importance of the permanent effort towards learning and generating knowledge in less developed countries, so that to allow for selection, acquisition or imitation, transformation and internalization of the technology.

Another major element is the recognition of the relevance of incremental innovations, essential for the less developed countries which hold innovative capacities that are both quantitatively and qualitatively distinct from those of countries situated in the technological border. In the same way, the relativization of the almost exclusive importance attributed to R&D efforts encourages small and medium enterprises, as well as those called “traditional industries”, of significant weight in less developed countries, to take the best of learning and innovation opportunities.

Finally, it advocates that the socioeconomic capacities, development paths and institutional evolution are quite differentiated in each country, originating innovation systems with very specific characteristics and dynamics. Insofar as the innovative

capacity of each country derives from the confluence of distinct factors and contexts, it emphasizes that both the analysis and the policies proposal are strongly dependent of the particular context of each country, and should be formulated with basis on the national dimensions of innovation systems.

3. Development Patterns and the Specificities of Less Developed Countries

3.1 Asymmetries, Specialization Patterns and Learning Divides

As already mentioned, the hierarchical structure of the world economic system is associated, by both the evolutionist and the structuralist visions, to the capacity of the countries to favorably (or not) position themselves in the innovation process. Those countries able to promote and dynamically participate in the process, tend to be more competitive and to attain better economic and social performance, as well as to hold greater power for influencing the world geopolitical dynamics.

To the extent that the diffusion of innovations is not immediate, countries technologically more advanced are able to guarantee an initial advantage that allow them to increase their participation in international trade by means of the launch of new products. As the generation of technology in those more dynamic sectors is recurrent, the trend of both technological asymmetries and the gap between the technologically advanced countries and the others is to accelerate.

The characterization of the "dual" dynamics of the capitalist system derives from this view, where the own development of the system simultaneously creates (and constantly re-creates) as much the virtuous development of the countries that lead the technological advancement as the underdevelopment in the vast and heterogeneous periphery on the fringe of the system (FURTADO, 1961). Such 'dualization' of the capitalist system determines the basis for unequal growth, for iniquities in distribution of the fruits of technical progress, and for income concentration in the global scale.

It, therefore, implicates the generation of quite distinct conditions for development and for incorporation of technological progress, which end up boosting a trend of intensification of the gap between countries. For instance, the technological asymmetries are the main factor in the determination of trade flows and specialization patterns at international level.

The developed countries focus their dynamism on knowledge intensive areas, specializing in the production and distribution of sophisticated goods and services. It enables them to keep dominance and leadership of the innovation process. As for the less developed countries, these tend to concentrate on areas of lesser technological intensity and lower productivity, generally associated to abundant factors such as natural resources and workforce. This activities, conversely to the knowledge intensive ones have a lower relative value in the international market. The unfavorable relation in terms of exchange ends up by creating hindrances to growth due to problems of external unbalance, thus characterizing the growth with external constraints.

From this analysis, derives the view by the Latin-American structuralist school that the break with the specialization pattern based on production and exports of low productivity goods and services could only happen through structural changes. In other words, the progressive shift of production factors (capital and labor force) from low productivity sectors to the ones characterized by high productivity were identified as a necessary precondition to a virtuous development pattern.

Several studies corroborate this thesis. They demonstrate that the main source of long-term economic development is based on technical progress and on the transformation of the productive structure promoted by this latter. Virtuous structural changes occurs parallelly with productions systems capable of promoting innovation, of accompanying the most dynamic trends of demand and of generating employments of high productivity.

The growth based on abundant factors does not have the capacity for neither inducing productivity expansion in the economy as a whole nor for promoting structural changes in the productive system. For being mostly founded on contemptible factors of competitiveness (low wages, environmental degradation, tax incentives, among others), this pattern of specialization reproduces the distributive inequality and the low quality of employment, besides accounting for low incentive to learning. It still presents a high degree of vulnerability, insofar as it is strongly bound to fluctuation of the world economy and to the behavior of demand. Conversely, the specialization pattern grounded on knowledge intensive activities show greater possibilities for replying to changes in the competitive environment, besides stimulating virtuous structural changes.

Cimoli *et alli* (2005), for instance, in a study encompassing the last three decades, demonstrated that the economies which attained the most expressive structural changes were those that sought to change their specialization patterns to dynamic sectors, through significant innovative efforts articulated with the productive sector. In analyzing the international pattern of industry specialization, the study indicates that the Latin-American economies have an unfavorable standing not only regarding the developed countries, as also in relation to several other less developed countries. This position regards as much to the participation of sectors spreader of knowledge in the industry as to the development of the productivity levels. The study, therefore, suggests that international convergence requires the less developed countries to be able, in the long term, to change their productive structure from a growth pattern based on incomes originated of the abundance of some production factor to other based on incomes generated by learning and knowledge. In this structural change, technology intensive sectors should reach increasing weight within industry.

Thus, considering the distinct impacts of the productive profile in both the productivity and on the growth dynamics of countries, the search for structural changes aimed at transformation of the specialization pattern is regarded as a key element of a long term development strategy in less developed countries. Furthermore, the selective intervention by the State is considered as crucial for directing the development towards a kind of productive specialization consistent with national needs and specificities.

Various authors advise that, whether keeping the current pattern of international specialization based on production and exports of products and services of high technology and value added by developed countries and on the production and export of obsolete goods and services of low competitiveness by the remaining countries, the trend will be the expansion of world inequality.

Still more worrying, however, is another caveat to what both the Latin American structuralist school and the evolutionist approach converge. Both these thoughts emphasize that worse than technological asymmetries, are those asymmetries in learning and knowledge degrees, which strongly restrict the access, the comprehension, the use and the diffusion of new knowledge in less developed countries (Arocena & Sutz, 2003).

It happens because the learning process relies on the existence of productive and innovative capabilities, which not always are available in these countries. To the extent that countries have increasingly more difficulty for accessing information and knowledge, and that the dynamism of the technological border is accelerated, the most difficult technological boundary to reach is undertaking virtuous processes of structural changes. Thus, this new factor (learning and knowledge asymmetries) further reinforces the already significant dual dynamic of the capitalist system, making higher the existing barriers to a more favorable insertion of less developed countries in the new technological paradigm and, consequently, in the world economy.

In summary, there is now a relative consensus around the idea that the main propelling force of productivity expansion is the technological learning, the innovation and their diffusion to the whole economy. Similarly, an increasingly great importance is attributed to technological differences as an explaining factor for the pattern of specialization, of the profile of comparative advantages and of productivity differences between countries, with direct impacts on employment determination and on inequality.

Furthermore, as Furtado recalls, "*it is possible to industrialize and grow without breaking the structure of dependence and domination that perpetuate underdevelopment*" (Tavares, 2001, *apud* Cassiolato and Lastres, 2008) Thus, FURTADO, like other authors of structuralism Latin-American tradition, adds to the obstacles above mentioned other hindrances of internal nature which restrict the possibilities for development in peripheral countries and among which inequality plays a key role. This issue will be best focused within the discussion of Brazilian experience.

3.2 Heterogeneity, Inequality and Development

The problem of structural heterogeneity, along with the question of specialization previously treated, constitute core issues in Latin American structuralist tradition. Both these matters are associated, in their origins, to the intensity and the persistence of asymmetries in the international economy. Enlargements of the technological gap are

reflected on the aggravation of the problems of specialization and structural heterogeneity, thus reproducing along the time both traits of the peripheral standing.

The structural heterogeneity – characterized by a very high participation of total employment in activities of low labor productivity – directly affects the development, thus restricting the possibilities of sustainable growth, the endogenization of the technical progress and the quality of employment.

The issue of structural heterogeneity has, therefore, a major relevance for the analysis of the relation between growth pattern, technological pattern and inequality. According to Latin American structuralist literature, to face heterogeneity requires reducing the percentage of employment in activities of very low productivity and raising it in activities of greater productivity by means of diversification of production structures towards activities characterized by higher density of technological learning and knowledge, and by greater dynamism of demand.

In the 1950s, the Latin American structuralist theory attributed the heterogeneity characteristic of peripheral countries to the coexistence of sectors of high productivity, which used modern techniques and generally connected to the incipient industry, with sectors of lower productivity, which used obsolete techniques and mainly connected to agriculture. The heterogeneity characteristic of that period showed a strong relation with dual productive structures, marked specially by significant differences of inter-sectoral productivity.

With the advance of industrialization and the adoption, especially in the 1990s, of policies of commercial and financial liberalization, the structural heterogeneity of Latin-American countries expands and its characteristics evolve towards a new pattern. Within a context of increasing importance of generation and diffusion of knowledge as a factor of competitiveness, the structural heterogeneity started incorporating not only inter and intra-sectors very high differences of productivity, but also differences in capabilities for generating, using and disseminating technological changes among the distinct economic agents (CIMOLI, 2005).

A study developed by MORTIMORE and PERES (2001) demonstrates that the increases in competitiveness in Latin America, started from the commercial liberalization, were concentrated in a small number of countries, sectors and enterprises, thus sharpening heterogeneity[5].

With regard to the enterprises, only those large, specially the ones with foreign capital, were able to positively reply to the policies of economic liberalization in the region; some of them internalizing the process of modernization through the incorporation of technologies similar to those prevailing in the international scenario, others establishing in the region already with high degrees of productivity and articulation with the world economy. At the same time when is taking place this process of consolidation of firms with world status, integrated to the world economy and holding high levels of productivity, however, an increase is observed in activities of low productivity and marked by informality, which account for the absorption of most of the workers entering in the labor market in the period.

[5] Cited by Kupfer, D and Rocha, F. (2005)

Thus, the increase of international competitiveness resulting from liberalization induced a process of business restructuring that, in most of the cases, could only be accomplished by a small number of large companies. The remaining were forced to resort to defensive strategies, based on the reduction of both costs and investments, on simplification of processes and products and, in some cases, on the embracing informal practices, all these leading to increasing intra-sectoral heterogeneity and to deterioration of the labor market (FERRAZ, KUPFER and SERRANO, 1999).

In this sense, it is worth highlighting that the sources of productivity expansion on the industrial labor in the region have not derived from redistribution of workers from sectors of low productivity to those of high productivity, but rather originate, principally, from changes in the intra-sectoral profile, thus widening, instead of reducing, the structural heterogeneity (CIMOLI et alli, 2005).

Moreover, the progressive expulsion of labor force from the industrial sector and the concomitant expansion of the informal sector constitute factors that have also contributed for aggravating the problem of structural heterogeneity in Latin America. In the absence of an economic dynamism able to absorb workers who lose their job posts in the industrial sector, the problems of unemployment, low quality of employment and the persistence of a significant part of the employment under informality are aggravated. Although the informality rates in the region used to be already high, they expanded during the 1990s, absorbing increasingly more people with low productivity levels, what have contributed to the reproduction of heterogeneity and of inequality along the time.

Finally, as we are going to discuss later on in this paper, it's important to mention the influence of demand on structural heterogeneity in Latin American countries. The highly concentrated pattern of income distribution in the region influences the demand structure through a sharp discrepancy of consumption patterns, which in its turn boosts a great heterogeneity of the production structure. The productive systems aimed at fulfilling the demand of the richest strata of population tend to stimulate both the implementation of technology intensive productive systems and the dependence on imported capital goods, reinforcing structural unemployment and social heterogeneity. At the same time productive systems targeting the needs of the vast majority of the population are outside of the concerns of policy-makers and tend to be considered as "naturally inefficient". Such dual patterns represent considerable hindrances to a greater productive efficiency and technological autonomy.

A development strategy aiming to break with this vicious cycle requires major structural reforms. In the absence of strategies based on the search for dynamic competitiveness derived from knowledge and able to generate significant structural changes and to promote innovation, the problems of structural heterogeneity in the region tend to aggravate. Localized expansions in productivity in the context of the economies characterized by low structural change are unable to reduce heterogeneity. Additionally, it's also extremely important to focus on demand side, in order to break with inequality and to counteract the concentrative and excluding trend.

3.3 Structural Changes and the Specific Importance of Policies

As already highlighted, the literature on innovation systems and the theoretical works of the Latin-American structuralist school converge in emphasizing that structural changes engendered by technical progress comprise the main determinant of development.

The core importance of structural changes pushed by innovation suggests the necessity to reconsider the role of public policies in guiding speed and direction of technological change. This is specially truth in least developed countries given the restrictions that derive of their peripheral condition. The subordinate role of technical progress that characterizes these countries, suggests that the assimilation, adaptation and creation of new techniques should occupy a priority position in any development plan.

However, in the two last decades of the 20th century the very intense presence of neo-liberal policies in underdeveloped countries had as central target the elimination of any important role for State in fostering structural change. Strongly influenced by international organizations and developed countries, these policies are totally in contradiction with economic theory and historical experience. No country has developed its productive base without resorting to active industrial policy. Both early industrialized and newly industrialized countries applied the same principle, although to varying degrees and in different ways (Cassiolato & Lastres, 2008).

What both economic theory and historical experiences show is that structural changes do not occur spontaneously, but result from an adequate development strategy and from active policies which allow for innovation process to conform to national needs and specificities. In this sense, they highlight the essential role played by the State in defining and implementing governmental policies able to direct and dynamize technological changes according to national specificities and needs (Freeman & Perez, 1988).

The evolutionist approach brings a significant contribution to this debate. It notes that the public policies are particularly relevant in periods of changing techno-economic paradigms. In these periods, learning become more difficult and the resistances derived from path dependency are intensified. Therefore, the State intervention is essential to internalize the benefits of the new paradigm and minimize its costs.

The Latin American structuralist school calls attention to some key points that should be taken into consideration for overcoming actual restrictions, among which the need of re-orienting technological progress and the creation of an efficient system of production based on a relative technological autonomy. Emphasizing the role of the State in guiding the technological change and in defining an industrial policy, it notes that the choice between distinct policy strategies brings significant implications to the long term growth path.

FURTADO makes an important remark recalling that technology in its own is not capable of creating the conditions to overcome underdevelopment, putting emphasis on heterogeneity and social inequality as structural problems of major relevance. In this sense, he suggests that is necessary "to make productive activities grow in a broad sense, that is, stimulate productive activities which not always aim profit, but that are essential for attaining the social goals" (2004, p.3). He highlights, in this aspect, how important is the selection of techniques aimed at social objectives. Therefore, the State also has a core importance in the adoption of active policies that enable to counteract the concentrative and excluding trend and to dismantle the archaic structures of underdevelopment.

4. Inequality, Innovation and Development – The Brazilian Experience

Brazil ranks at the 11th position among world's greatest economies, with a GDP of US$796.1 billion and a GDP per capita of US$4.271 in 2005 (UNDP 2007/2008)[6]. Although these economic indicators could hardly characterize a poor country, in 2005 there were 55.4 million poor people and 20.6 million indigent people in the country, which represented respectively 30.7% and 11.4% of the Brazilian population (IPEADATA, 2008). This huge contrast reveals a country where poverty is neither rooted in absolute nor in relative scarcity of resources. It rather results of a deeply unjust society, where the unfair distribution of national income and wealth has historically characterized the socio-economic structure of the country.

As Furtado (1986)[7] pointed out, dealing with underdeveloped countries requires a special methodological approach. In the Brazilian case, to consider the questions of poverty and inequality and their social, political and economic implications becomes fundamental not only for apprehending the magnitude of existing challenges, but also, and specially, for the formulation of appropriate public policies. This latter not restricted to the social area, but rather comprising the set of policies that both affect and are affected, either directly or indirectly, by the status of structural inequality prevailing in the country. This heritage of social injustice, that hinders the access of a significant part of the population to minimal conditions of dignity and citizenship, brings on the additional challenge of pursuing development strategies that get to combine economic growth and social inclusion.

In this context, the discussion on a national innovation system (NIS) should be articulated to this specific dimension of the Brazilian underdevelopment. Especially because one of the fundamental aspects for understanding the particularities of and the

---

[6] According to the World Bank's methodology of purchasing power parity, Brazil presented a GDP PPP of US$1,5851 trillion in 2005, representing 2.88% of the world GDP PPP, corresponding to half of Latin American economy. Such figure situated the country as the tenth greater economy in the world, following USA (US$12,3761 trillion), China (5,3332), Japan (3,8703), Germany (2,5148), India (2,3410), United Kingdom (1,9017), France (1,8622), Russia (1,6975) and Italy (1,6263). The Brazilian GDP PPP per capita reached US$ 8.606 in 2005.

[7] Furtado, C. (1986) *Teoria e política do desenvolvimento econômico*. São Paulo: Nova Cultural (2ª edição).

obstacles posed to our NIS is related to the huge disparities of income distribution and of consumption patterns observed in Brazil, which shape a deep and complex social heterogeneity. A heterogeneity that is reflected in every sector of activity including the productive sector and the technological and scientific dimensions.

In this section we will look for discussing some dimensions of the relation between inequality, development and the National Innovation System. At the end of it, some suggestions are made in the sense that the innovation policies in Brazil get to contribute as much to the improvement of dynamic competitive advantages, as to the construction of a more fair and equitable society.

4.1 Poverty and Inequality – Patterns and Trends in Brazil

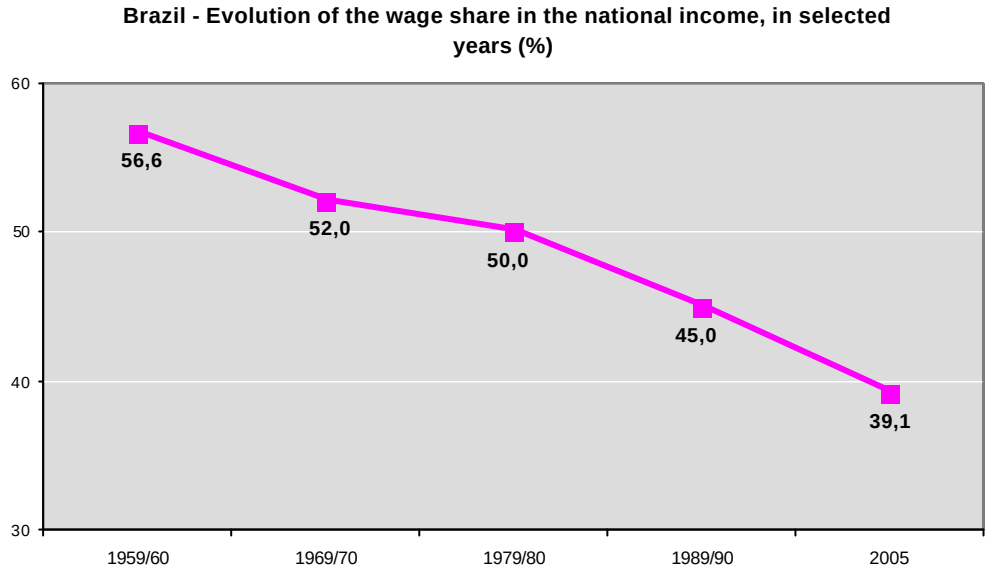
The GINI index – 0.57 in 2005 – reveals how deep income inequality in Brazil is. This index puts the country, just as the GDP, also in the eleventh position in the world ranking, but now amongst the most unequal countries. The 20% poorest Brazilian people hold only 2.8% of the national income, whereas the 20% richest ones appropriate 61.1% of this income (UNDP 2007-2008). Quite more alarming, however, is the fact that the small group comprised by the richest 1% of the population concentrates a share of income (13.3%) higher than that appropriated by half the whole Brazilian population (12.6%) (IPEA, 2001)[8], portraying a distributive profile of dramatic social injustice.

Moreover, when we take into account also the pattern of wealth distribution, besides that of income, the scenario of inequality is aggravated[9]. According to Pochmann (2008), between 1980 and 2005, the participation of labor income in the national income decreased 11%, falling form 50% to 39%. The author points out the growing process of financialization of Brazilian wealth, in course since 1981, as the main factor explaining this sharp inflection in the functional distribution of income that favors returns on property. As a consequence, the richest 10% of Brazilian population at the end of the 20th century held 75.4% of the whole national wealth[10].

[8] Cited by Barros, R., *et alli*. (2001) *A estabilidade inaceitável: desigualdade e pobreza no Brasil*, IPEA (Discussion paper nº. 800).

[9] SALM (2006) recalls that personal distribution and functional distribution of income comprise two complementary views in the analysis of income distribution, although not necessarily convergent. It is possible occurring improvement in the personal income distribution (labor remuneration), without a betterment in the total income distribution, due to deterioration in the functional income distribution. This is the case when returns on property (land and capital) raise *vis a vis* labor income (labor force). As a result, nothing can be said about the total income distribution based only on the analysis of personal income distribution.

[10] Pochmann, M. (2007) *Desenvolvimento e processo de exclusão social: a experiência brasileira recente*, (draft).



Source: Ipeadata

Furthermore, irrespectively of income magnitude, factors such as the enormous regional heterogeneity, ethnic and racial differences, gender issues, asymmetries regarding occupation, and distinct opportunities for social and economic inclusion constitute important forms of reproduction and perpetuation of inequalities. These and other social, cultural and political inequalities fix the distance existing between rich and poor people in the country, and can be as deplorable as income inequality.

There are two aspects worth emphasizing. The first one is that, in spite of the amplitude of poverty and privation in Brazil, these problems are strongly concentrated. It is in the regions North and Northeast, in the rural areas and in the small towns that the main deficiencies: lower schooling, less access to infrastructure services supply, less access to manufactured durable goods, and prevalence of worse quality dwellings. Secondly, despite its apparent homogeneity, poverty hides very distinct social circumstances and is an outcome as much from the reproduction of obsolete forms of productive integration and anachronistic institutions, which occur particularly in the rural world, as from unemployment rates and the low wages that characterize the low qualified work prevailing in urban areas[11].

In brief, poverty and social exclusion in Brazil are not restricted to minority groups in the society, they rather occur through multidimensional and heterogeneous forms, characterized by strong regional and sectoral concentration (rural / small towns). Therefore, facing these problems requires, as will be forward seen, broad public policies, aimed at fostering innovation, reducing wealth concentration and improving participation and social cohesion, taking into account the territory where social and power relations are structured, which is also heterogeneous and differentiated.

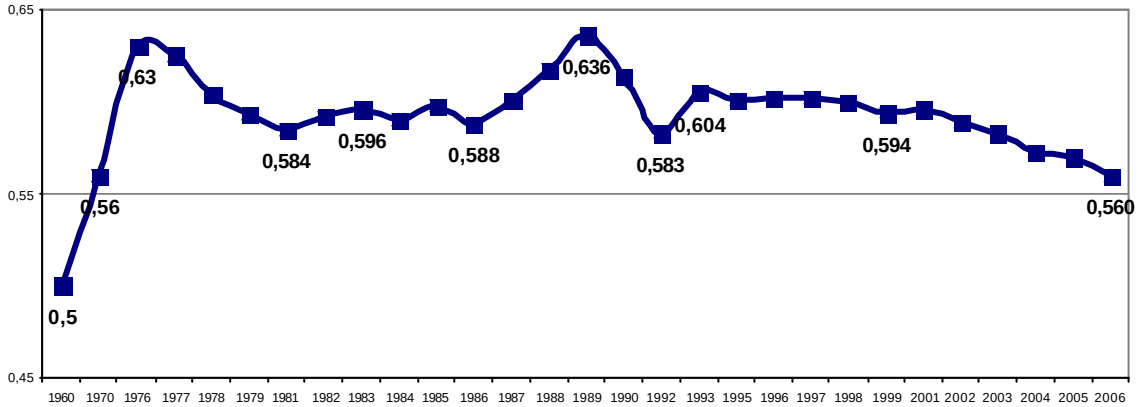
[11] Medeiros, Carlos – *Desenvolvimento Econômico, Heterogeneidade Estrutural e Distribuição de Renda no Brasil*.

Moreover, high poverty levels and strong inequality of income distribution do not constitute recent situations in the Brazilian society. In fact, inequality has been established in the country as a historical legacy since colonization. The Brazilian original social matrix, determined by concentration of land and of political power, as well as by external dependency, imposed its trace to the whole process of historical constitution and evolution of Brazilian nation. Coalitions constituted in Brazil by distinct economic and political powers of each social class, particularly those of landowners and capitalists in relation to urban waged workers and the rural mass, are the outstanding mark of Brazilian capitalism. The force of these distributive coalitions lies on the inertial and iniquitous distributive pattern observed in Brazil[12].

Therefore, a remarkable characteristic of inequality in Brazil is the persistence of income and wealth concentration throughout the various periods, political regimes and patterns of development undergone by the country, in spite of the significant structural changes realized. From colonization to nowadays, wealth has been quite iniquitously shared among the whole of Brazilian population.

As highlighted by Pochmann (2007), in spite of the great economic progress reached by the country, particularly between 1930 and 1980 (period characterized by the national industrialization), Brazil failed in accomplishing the civilizatory reforms of capitalism (agrarian, taxation and social) and thus was unable to deal with the problems related to wealth concentration and social exclusion. Not even public goods got to be universalized so that to offer equal opportunities for education, health, housing and transport services to the population. Thus, even in that period there was no substantial change in the distributive profile of the country[13].

Brazil : Evolution of inequality in the distribution of personal income in selected years (Gini Index)



Source: IBGE

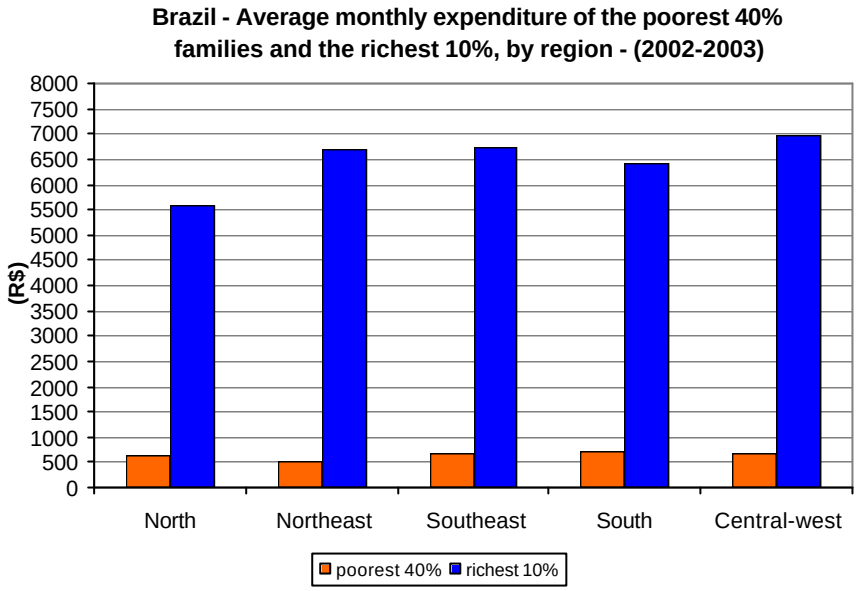
4.2 Inequality, Heterogeneity and the National Innovation System

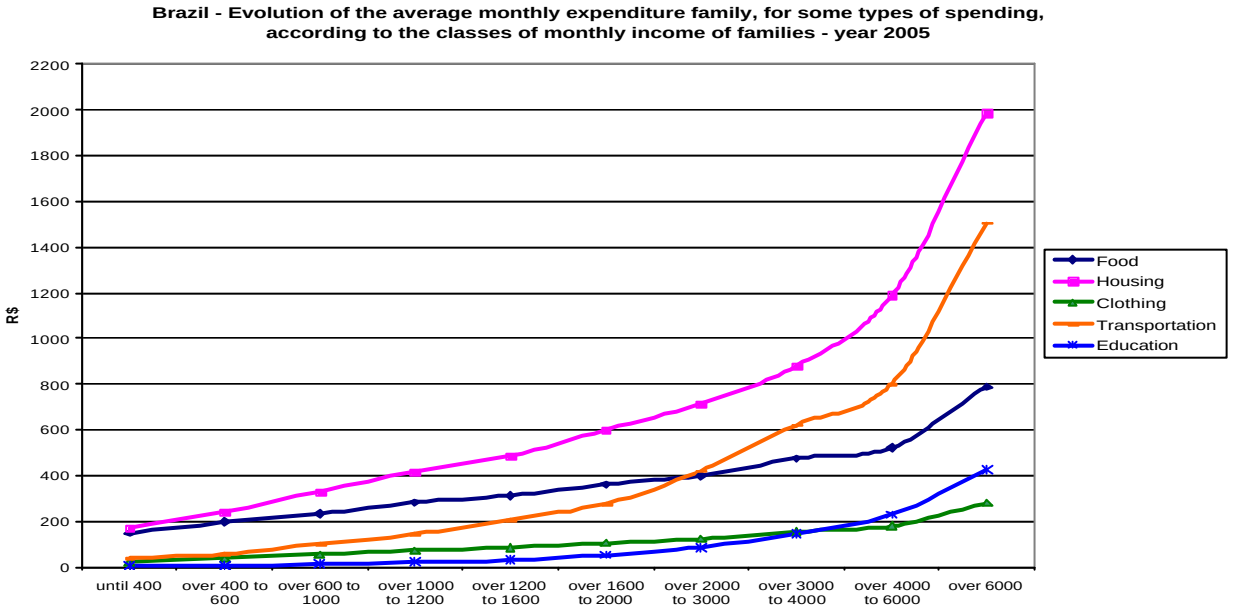
[12] For further details on this, see Medeiros, Carlos - *op cit*.
[13] For further details, see Pochmann, M. *op cit* .

In this section we analyzed how income and wealth concentration in Brazil determines a pattern of demand extremely heterogeneous, which simultaneously affects the organization of domestic production and the national innovation system. The approach is based on emphasizes given by evolutionist perspective (Dosi, 1998) on the role of demand as the main determinant of the rhythm of technological advancement.

The inequality pattern prevailing in Brazil affects the consumption patterns and the demand structure of Brazilian economy. The drastic disparity between purchasing power of the rich and the poor segments of the society[14] (not mentioning those practically excluded from the consumption market), as well as the strongly concentrated character of poverty in regional (North and Northeast) and sectoral (rural / small towns) terms, as previously mentioned, contribute to a extremely heterogeneous pattern of demand in Brazil.

[14] In the period of 2002-2003 the monthly average expenditure of the 10% richest families was 1000% higher than that of the 40% poorest families, according to data from IPEADATA.





Source: IBGE - Pesquisa de Orçamentos Familiares 2006

However, the differences observed when we analyze the consumption pattern of families according to income groups are not restricted to the quantitative aspect presented in the chart above; they rather are expressed also qualitatively. That means, besides consuming goods and services in lower quantities, poorer families tend to acquire products and services of lower quality (and price), which are compatible with their diminished power of purchase. Table below illustrates this question by comparing the acquisition of substitute food products according to per capita income group.

Annual per capita household food acquisition (kg) by class of monetary income (2003)

Products	Annual per capita household food acquisition (Kg)						
	Total	Classes of monthly monetary and non monetary household income					
		until 400	over 400 to 600	over 600 to 1000	over 1000 to 1600	over 1600 to 3000	Over 3000
Premium beefs	6,010	2,285	3,459	4,529	6,354	8,760	10,669
Sale beefs	7,143	5,969	6,976	7,336	7,790	8,765	5,580
Fresh cow milk	15,607	15,225	17,639	19,571	17,824	12,803	8,952
Pasteurized cow milk	27,055	8,579	13,581	20,285	29,299	40,039	50,153
Crystalline Sugar	12,162	13,410	14,388	14,077	12,269	10,687	7,686
Refined sugar	6,106	4,972	6,490	5,364	6,475	6,330	7,262
Olive oil	0,193	0,070	0,152	0,140	0,164	0,167	0,497
Soy oil	7,332	6,627	7,505	6,874	8,165	8,224	6,517
Sugar cane rum	0,216	0,206	0,304	0,178	0,235	0,168	0,227
Bier	4,572	0,596	1,303	2,740	4,418	6,533	12,135
Cola soft drinks	9,091	2,452	3,793	6,320	9,131	12,633	20,498
Other soft drinks	4,540	1,782	2,380	3,582	5,449	6,801	6,979

Note: similar colors indicate substitute products

Source: IBGE Pesquisa de Orçamentos Familiares 2003

This heterogeneity of demand tends to determine a productive pattern far less homogeneous than that of countries with less unequal income distribution. A facet of such heterogeneity of Brazilian productive structure may be observed, for instance, in the coexistence of distinct productive systems of quite distinct technological base within a same sector and frequently within a same industrial plant directed to different markets in terms of income. Therefore, a same manufacturing unit may present a technologically modern line of production, aimed at manufacturing products directed to the higher income groups of the population, along with another production line, of low technological complexity, aimed at supplying the demand of the low income population.

In other words, the existence of a low income consumer market in the country allows for the survival of production activities of very low productivity based on spurious competitive advantages such as low paid work which is enabled by the enclaves of poverty existing in the country. Concomitantly to these low productivity activities, others are observed, which are aimed at supplying the consumption market comprised by the country's rich socio-economic elite that adopts consumption patterns similar to those of developed countries. The productive structure aimed at supplying the demand of this segment of high purchasing power is characterized by greater dynamism, by producing goods containing greater value added and by the use of capital-intensive techniques, generally based upon imported technologies.

According to FURTADO (1986), the technological determinant in peripheral countries is associated to the degree of diversification of the demand by socio-economic elite, which tend to follow the consumption pattern of the core countries. Although representing a quite small proportion of the population, the elite in Brazil hold a high purchasing power and capacity for consolidating its consumption pattern in the internal

market. This process allows, on the one hand, for a relative update and sophistication of the domestic industrial park. On the other hand, the internalization of these productive activities is made predominantly with base on imported technology and, given existing restrictions of scale and scope, tends to incentive a process of imports of capital goods, presenting a low concatenating effect on the economy.

The industrialization process, in this perspective, takes the form of a permanent effort for adaptation of the domestic productive system to the sophisticated pattern of demand created by the elites, with practically no links to the productive forces and to pre-existent technological capacity, and so constantly renewing the bonds of dependency. The use in these industries of capital-intensive techniques without correspondence with the actual accumulation level of the society and generating productivity gains with raises in unemployment contributes for reproducing structural inequality[15] and leads to a restricted pattern of growth. The concept of 'technological inappropriateness' developed by the structuralism school seeks to characterize the persistent blockade to endogenous technological development that is generated by this polarization modernization-marginalization[16].

As Furtado (1986) emphasizes, *"... the main factor accounting for the elevation of productivity in the industrialized peripheral economy seems to be the diversification of consumption patterns of high income minorities; the process not necessarily having repercussions in the life conditions of the major part of the population"* [17]. Furtado (2003) also recalls that *"The logic behind capitalism is income concentration, but in itself it engenders social forces that will press it to deconcentrate. And its development emerged from the interaction of these forces, on one hand, technological progress generating unemployment, on the other social movements pressing for creating employment. It was so in countries where capitalism has fully developed: the social struggles allowed for income deconcentration (…). However, in an underdeveloped country, which accumulates backwardness it does not occur: society is unable to move a reaction strong enough to change this context. In Brazil such a dynamism of the capitalist system is absent because social movements are weak" (p.17) … "Here, the trend towards inequality is only reduced during stages of strong growth of international exchanges. Hence the importance of the political factor" (p.16).*

Therefore, in the core countries pressure by social movements plays a major role in the inclusion of workers in the share of the fruits of technological progress, generating positive effects on the guidance of the technological path, insofar the growing demand allows for economies of scale and scope, products diversification and productivity increments.

[15] Albuquerque, E. (2007b) warns that, even when the restricted domestic industry of capital goods starts internalizing the production of some capital goods previously imported, it is unable of reverting the phenomenon of the growing structural unemployment.

[16] For further details, see Albuquerque, Eduardo (2007a) – *Propriedade Intelectual e Estratégias para o Desenvolvimento*, draft.

[17] Furtado, C. (1986, p 182) *apud* Albuquerque, E. (2007a) op cit, pg.9.

Conversely, the industrialization process in Brazil brings with it renewed forms of structural unemployment, given the organizational fragility of social forces. Also limited is the capacity of these forces to pressure the State to adopt universalizing social policies. Thus, the fruits of the productivity gains end up being appropriated by a limited part of the population and the internal market (mass consumption) stay restricted, hindering the impulse to development and the possibilities of technical progress.

The polarization modernization-marginalization, therefore, characterizes a specific pattern of development, in which the vicious cycle of underdevelopment recurrently reproduces itself. Because of it, the implementation of developmental policies in Brazil in the post-war period, in spite of having leveraged the construction of a complex industrial structure, was unable to overcome the structural traits of underdevelopment, as evidenced by both the persistence of a deep heterogeneity in its multiple dimensions (social, productive etc.) and the subordinated and dependent technological pattern.

A development strategy aiming to break with this vicious cycle requires major structural reforms, among which the designing of new institutional arrangements able to break with inequality and with the polarity modernization-marginalization. The State, in this context, has a core importance in the adoption of active policies that enable to counteract the concentrative and excluding trend and to dismantle the archaic structures of underdevelopment.

Given the core importance of innovation, learning and building capabilities for the contemporary development process, another major element in the structure of these new institutional arrangements is related to the connections between problems arisen from income concentration and the technological issue. The implementation of active policies aimed at strengthening the endogenous technological capacity and the national system of innovation, in connection with the objective of social inclusion, constitutes, in this context, a fundamental part of this arrangement.

4.3 Innovation and Development: the Role of the National Innovation System

NIS in Brazil and the Reproduction of Inequalities

The elements previously discussed bring us back to the reflection on the Brazilian development process, particularly focusing on how innovation can contribute to improve inequality.

Worth to mention the emphasis brought by the evolutionist approach on the importance of both geography and history in the process of development and for designing national innovation systems. It also emphasizes the complexity of both processes and agents that structure the distinct institutional arrangements and technological paths.

In this sense, the National Innovation System in Brazil is permeated by structural characteristics of a peripheral and highly unequal and heterogeneous country. Its institutional conformation has served the current pattern of accumulation, both reflecting and contributing to reproduce actual inequalities.

So that if, on the one hand, inequality affects the national innovation system restricting the endogenization of technological progress and limiting the capacity of acquisition, use and diffusion of innovations in the country, on the other hand, the current dynamic of Brazilian innovation system contributes to the reproduction and perpetuation of the vicious cycle of inequality.

The asymmetries of the national innovation system can be observed in its different dimensions and subsystems, both reflecting and contributing to reproduce a dynamic of exclusion and inequality in the country.

A clear example is the infra-structure of science and technology, which is characterized by strong asymmetries. Perhaps the most evident of them being the disparity in the access to quality education (in its diverse levels) depending on the income group one belongs to. The limitations faced by the poorest people to access a quality public education restrict their opportunities in the labor market, reinforcing iniquity. On the other hand, the low quality of education provided to the great majority of the population has a negative impact on the internal capacities for learning and incorporating, disseminated and generating innovations. It also limits the development of important sources of diversity of social agents and institutions jeopardizing the national system of innovation. Another example is the spatial concentration of centers of excellence and of technological services, which similarly reflects and reinforces socio-regional inequality.

An equal pattern can be observed by the strong concentration of investments in innovation in the large companies, in the regions South and Southeast, and involving a very small segment of the workforce in the country[18]. The other pole comprises micro and small enterprises, cooperatives of production, family farmers, and forest dwellers, among others, especially those located in regions North-Northeast, with major participation of poor people, a precarious insertion in the labor world, and which tend to stay marginalized if not excluded from the necessary support to the innovation process[19].

Furtado calls attention to some key points that should be taken into consideration for overcoming actual limitations, among which the need of re-orienting technological progress and the creation of an efficient system of production based on a relative technological autonomy. Furthermore, he explains that technology in its own is not

[18] For further details, see Pochmann & Wohlers, *Principais Características da Inovação na Indústria de Transformação no Brasil*, IPEA, Comunicado da Presidência no. 5, maio 2008.

[19] The analysis of the current configuration of the national innovation system in Brazil and its implications for the reproduction of poverty and exclusion in the country must be carefully regarded. Given the limits of scope of the present work, this aspect will be further explored in future studies of Redesist.

capable of creating the conditions to overcome underdevelopment, putting emphasis on heterogeneity and social inequality as structural problems of major relevance. In this sense, he suggests that is necessary "to make productive activities grow in a broad sense, that is, stimulate productive activities which not always aim profit, but that are essential for attaining the social goals" (2004, p.3). He highlights, in this aspect, how important is the selection of techniques aimed at social objectives.

Overcoming this vicious cycle of restricted growth, limited technological updateness and continuous structural underdevelopment involves not only quantitative factors, but especially qualitative aspects; in particular there is an urgent need for changing the deeply rooted institutional structure that serves the dominant sectors and social classes perpetuating inequalities (Albuquerque 2007a). The author compares this institutional structure to the 'lock-in' phenomenon brought by evolutionary tradition[20]. He further remarks that the existing institutions of the innovation system have served the current pattern of development, but do not necessarily would comprise the basis of a new development pattern which provides for social inclusion. In this perspective, he points out that in Brazil the inclusive development depends upon breaking this 'lock-in' and suggests that the challenge to be faced implies not only the improvement of democracy in the country, as also the identification of a pattern of technological development which allow for escaping the structural polarity modernization-marginalization.

Therefore, considering that the current dynamic of innovation system in Brazil contributes to the reproduction of inequality, a major question is placed: What pattern of technological development should be sought in order to break with this perverse dynamic and to escape continuous reproduction of polarization? And, in this sense, what structure of national innovation system should be pursued?

In this paper, our reflection is based on the premise that the emphasis must be put on broad innovation policies, based on a systemic approach of a National Innovation System. The proposed hypothesis suggests that the interactive construction of both innovation systems and systems which meet the priorities of social development may contribute to reduce the "modernization-marginalization" polarization, thus leading to a less unequal pattern of technological development which would be more consistent with a national project of long term development[21]. However, we will first precede a brief account of the recent policies aimed at reducing poverty in Brazil.

[20] The author exemplifies citing Nelson (2004, p.12) "*Accomplishing the necessary reforms of economic structures can be a harder task than that of acquiring the required scientific and engineering knowledge for operating the new Technologies"*. A reason *"is the political power of the established firms and industries and the difficulties that may be posed to their changes. For the established firms, with stable situations and good relationships, the process of creative* destruction is not an easily dealt with".

[21] The recognition of a connection between problems resulting from the iniquitous pattern of income distribution and the matter of innovation is an important point to be further explored in future researches on NIS in Brazil, particularly for its implications to the design of policies. A dimension to be considered is the differentiated territory where the social relations are structured in the country, as well as the relationships between different social groups and the distinct ambits of government.

The Limits of Social Policies in Brazil

According to Fagnani (2007), in the Brazilian trajectory of social policy during the last decades it is possible to recognize two opposite movements. The first one aims at structuring the institutional, financial and protection bases typical to the Welfare State. This movement has its origins in the social struggles for democratization of the country and has its apex in the Federal Constitution of 1988. Through the constitutional reform, the embryo of a universal and equitable Welfare State has been designed for the first time in Brazilian history, based on values of universality, solidarity, social security and understanding of the social matters as right of all citizens (countervailing the views of charity, philanthropy) [22].

The second movement gains impetus as from 1990, with the cycle of liberal and conservative reforms, and is based on the thesis of Minimalist State. This perspective ascribes a predominant role to unequal distribution of assets (especially educational) and to distorted public policies for explaining the causes of persistent poverty and high income concentration in Brazil, irrespectively of the country's production and social structures. It minimizes the importance of economic growth and its impacts on employment and labor income as relevant factors for reducing both poverty and inequality. It advocates the flexibilization of labor legislation as a way for facing unemployment. It considers too high the Brazilian public expenditure and disapproves universalizing social policies on the grounds of threatening the stability of public accounts and reproducing privileges, thus favoring richer ones[23].This perspective, strongly stimulated by multilateral bodies such as the World Bank, has been predominant in the design of public policies for facing poverty in Brazil since the end of the eighties.

Although an effective strategy for reducing poverty in Brazil cannot be done without emergency policies of income transfer able to free marginalized segments of the population from extreme poverty, making this axis the main strategy for facing social poverty in Brazil is ignoring the structural aspects of poverty and misery in the country. It is not possible to reduce poverty by means of focused policies in a country where more than 40% out of the population are poor or indigent people – nothing less than 76 million people. It is not a surprise that the outcomes of these policies have been insignificant, as one can observe from the poverty and indigence indicators of the country in the last decades.

Bringing back the lessons from the Latin American Structuralism tradition, the fight against poverty and inequality must give priority as much to social reform as to the demand structure and the adoption of systemic policies designed to foster the economic dynamism. This tradition understands that the lack of growth deteriorates the labor market, restricts both tax collection and resources for social policies, besides devaluating educational capability due to missing opportunities[24].

[22] Worth remarking is that such achievements happened countervailing the neoliberal thought, which has been hegemonic since the late seventies, thus reflecting the achievements of the broad social movement organized in the country around the fight against the military dictatorship. For further details see Fagnani, Eduardo - *Como Incluir os Excluídos*, 2007.

[23] For further details see Pochmann & Fagnani, 2006.

[24] As recalled by Salm (2006), "*while persisting in the country high contingents of people either mining their subsistence in low productivity activities or simply unemployed, in the countryside or, as increasingly today, in the cities, there will be no way to substantially improve our income distribution,*

As recalled by Medeiros (2003), once the relation between wages of qualified and non qualified workers is affected by the value of the wage paid at the base of occupational hierarchy, without the expansion of modern employment and in the absence of changes in the structure of occupations, the contingent of underemployed and underpaid would hardly be reduced and equally difficult would be changing the context of social exclusion. For so doing, a favorable evolution of effective demand along with both diversification of production structure and technological modernization is essential. Even without directly impacting functional income distribution, the expansion of the average real income and the creation of employment in regular activities tend to reduce the poverty levels and to improve the personal income distribution

Therefore, the State intervention on macroeconomic variables able to stimulate global demand and foster growth (such as interest rates, exchange, and investment rates) is deemed fundamental for its impacts on either the creation of employment or the reduction of poverty and inequality. However, it must be emphasized that growth, in spite of being a necessary condition for assuring any path to a sustainable reduction of inequalities, does not suffice to overcome the current situation, on the grounds of the recurrent creation of misery enclaves. Additionally, poverty is also a state of 'disempowerment', of deprivation of capabilities of access and of opportunities, and thus cannot be faced only through the provision of resources. These are the grounds for the need of articulating economic development and social inclusion.

Emergency policies, in this perspective, must be embedded in a set of structuring policies. Targeting development with income re-distribution, the structuring policies are fundamental for providing the required amplitude and sustainability for the process of poverty reduction, aiming at not only guaranteeing the survival of those socially excluded, as also assuring their citizenship and rights, among which the right to work, to learn and to have a decent payment[25]. Such diagnosis, which is shared by the present study, certainly points to a distinct design of policies aimed at meeting a more distributive justice.

In order to accomplish development with income and wealth distribution and social inclusion, many challenges must be faced. As previously mentioned, besides changing the iniquitous combination that has characterized the main macroeconomic variables in the country; promoting diversification of the productive structure and technological modernization; and facing the structural deficiencies in the field of the Welfare State (by means of universalizing social policies) [26], it is necessary to defy the archaic

---

even if indicators of school attendance significantly raise and if cash income is transferred to those most vulnerable contingents." op cit p. 10.

[25] In opposition to the dominant perspective, this approach considers unrealistic supposing that by means of fiscal transfers it would be possible to significantly change the distributive profile of countries with high degrees of poverty and income concentration like Brazil. More importantly, it emphasizes that the income transfer to the poorest should not disregard the right to work and to appropriate remuneration, both of them central elements of distributive justice.

[26] Here, reference is made to the need of governmental policies for universalization of basic rights and services in the areas of public health and education, social security, housing, sanitation, public transport, among others.

powerful structures which persisted historically and which are the fundamental pillars of inequalities reproduction[27].

For so doing, it is indispensable to include the issues of democracy strengthening and social control on the State in the agenda of development. Without changes in the relations of power that have historically produced and perpetuated inequality, it will not be possible to break the spiral of impoverishment and exclusion prevailing in the Brazilian society. Making room for social participation in the debate and design of public policies may contribute to break the corporative, patrimonial, *clientelista* and authoritarian logic of Brazilian State, which favors the private appropriation of public resources.

In this perspective, the National Innovation System should also be reoriented to constitute a central element of systemic policies aiming at simultaneously boosting economic dynamism and social inclusion.

In the next topic, based on the evolutionary view of National Innovation Systems, we aim at exploring the hypothesis of interactive development of innovation systems and systems which meet the priorities of the social development as an alternative for building a least unequal pattern of technological development, more consistent with a national project for long term development.

The necessary articulation between Innovation Policies and Social Policies

The hypothesis of this work suggests that the configuration of a technological development pattern which escapes such polarization must, necessarily, include its own articulation with policies that promote social inclusion. The interactive development of both innovation systems and systems that meet the priorities of social development can be an alternative for attaining this objective (Sutz & Arocena, 2006; Cassiolato, Soares & Lastres, 2008). In this perspective, the national innovation system must be devised deeming social inclusion as a key variable.

It is important to emphasize that the integration of the segments of Brazilian population, socially excluded or precariously included, to appropriate conditions of consumption, concurrently to the search for the improvement of the social services infra-structure (health, sanitation, housing etc.), may represent a great challenge to innovation policies.

This is because the incorporation of these segments means expanding the demand for goods and services, with effects of inducing investment and innovation. In the words of Albuquerque (2007b) *"... changes in demand patterns would be matched by expansion and improvement in traditional industries that would create opportunities for absorption and adaptation of new technologies available in international markets and also push the innovation system to deal with old problems with new solutions: housing, health, urban infrastructure, etc."* (p. 684)

[27] It is worth emphasizing that the developmental agenda aimed at reconciling economic growth and social inclusion transcends the limits of this work. It comprises distinct elements like the expansion of the economy and the eradication of dependency; the creation of a strong internal market; the protection of the right to work and to social security; raise of the minimum wage; universalization of basic social services and rights; the fulfillment of tax reform towards progressive taxation; agrarian and urban reforms; among others.

Concurrently, the expansion and improvement of public services in the areas of education, health and other services integrating the Welfare State would reduce inequalities, provide better life conditions to the population and contribute to improve internal capacities of learning and acquisition, use, adaptation, diffusion and generation of innovations in the country. Better qualification and ascending mobility of workers, sophistication of labor division, productivity gains, and expansion of domestic market among other positive feedbacks for the technological change and for social inclusion, are also usual outcomes of universalizing social policies.

On this purpose, social policies, besides addressing social needs, should help to enhance capacities to do new things, to integrate new technologies into everyday life, and to solve problems by making the most extensive use of knowledge. As Hirschman pointed out, underdevelopment is a result not only of weak capabilities but, even more, of the sub-utilization of existing capabilities. Social policy demands for innovation could be an instrument to overcome the lack of sustained, inward oriented, knowledge demand coming from production that characterizes underdeveloped countries, opening opportunities to put available capabilities to work for development purposes. In this sense, socially oriented innovations could foster the social utility of scientific and technological knowledge locally available that are currently underutilized. (Cassiolato, Soares & Lastres, 2008)

Palliative interventions designed to and focused on extreme poverty situations that lack a broader systemic approach usually fails to be sustainable in the medium and long term. If the ultimate goal is social inclusion, the approach cannot be restricted to focalized solutions for alleviating poverty or other specific deficits. Improvements due to innovation should also generate a broader dynamic process of societal change, including the generation of local learning processes and capabilities for problem resolution.

Consistently, the national innovation system could contribute to the implementation of these social welfare policies, among other ways by means of 'mission oriented projects' (Freeman, 1996) so that to redirect technological progress toward specific objectives that allow for complying actual institutionality with new demands resulting from social reform. In this same sense, Furtado (1986) emphasized the need for prioritizing techniques aiming social objectives, stressing the notion of a required re-direction in the agenda of the national innovation system towards a better convergence between technological advancement and social inclusion[28].

On this purpose, however, deliberate efforts for policies aiming at the articulation between innovative activities and social development are necessary, insofar the traditional mechanisms of market tend to disregard innovation in these areas.

As emphasized by Cassiolato, Soares & Lastres (2008): "*State purchasing power and other public policy instruments should be used to stimulate social demand for*

[28] Projects oriented by mission, defined as economically viable technical solutions aimedd at specific social objectives. For further details, see ALBUQUERQUE, E. (2007b).

innovation, assure the generation and diffusion of the solutions and promote the accumulation of knowledge and productive capabilities in a wide range of productive sectors supportive to fulfilling social needs. Academic research incentives and university reward system could also be valuable instruments to foster problem-solving inventiveness. Additionally, national innovation efforts oriented by social policy demands might be an important instrument to stimulate research in areas without market interest but critical for social well being, such as tropical diseases and other under-researched issues. Similarly, new low cost solutions could be fostered in order to broaden coverage and access by the poor population, together reducing the gaps and enhancing innovation capabilities."

However, precisely because socially oriented innovation should be integrated in the broader scope of development trajectories, policies aiming at activating the processes of knowledge generation and use are embedded in complexity and cannot be considered de-linked from social, political and economic powers.

In fact, the constitution of interaction between innovation systems and systems that meet social priorities shall be fruit of both institutional construction and long term structural reforms, which result from political decisions and articulations between State, market and society (Albuquerque 2007a). The viability of such proposal is conditioned to the strengthening of democratic processes in the country and to the capacity for dealing with the potential conflicts that will necessarily arise.

To sum up, the interaction between welfare systems and innovation systems can generate extremely positive synergies in terms of growth, efficiency and equity, thus constituting a significant link in a proactive strategy for development with social inclusion; a strategy in which the State must play a core role. However, strategic changes are needed to put STI on behalf of social needs. Beyond the usual target of increasing international competitiveness and promoting economic growth, innovation policies should put focus on the resolution of social pressing problems and interconnected development issues, making room for the development of productive specialization in important areas, the building of new product lines and business opportunities, fostering local level innovative dynamic, etc besides contributing to improving life conditions and the capabilities of the poor.

REFERENCES

ALBUQUERQUE, Eduardo (2007b) – *Inadequacy of Technology and Innovation Systems at the Periphery*, Cambridge Journal of Economics 2007, 31, 669-690.

CASSIOLATO, J.; LASTRES, H. (2008) – Discussing Innovation and Development: Converging Points Between the Latin American School and the Innovation System Perspective? ; GLOBELICS Working Paper Series, No. 08-02.

CASSIOLATO, J.; SOARES, M. C.; LASTRES, H. M. M. (2008); Innovation in Unequal Societies: How can it contribute to improve equality? Seminario Internacional Ciencia, Tecnología, Innovación e Inclusión Social, UNESCO, Montevideo, mayo 2008.

CIMOLI, Mario ed (2005) – Heterogeneidad Estructural, Asimetrías Tecnológicas y Crecimiento en América Latina, CEPAL/BID, noviembre 2005.

FAGNANI, Eduardo (2007) – *Como incluir os excluídos,* CESIT/UNICAMP, Carta Social e do Trabalho, n. 7, set/nov.

FREEMAN, Chris (1982), *The Economics of Industrial Innovation*, London: Frances Pinter.

FREEMAN, Chris (1987), *Technology Policy and Economic Performance*, London: Pinter.

FURTADO, Celso (1986a) *Um Projeto para o Brasil*, Rio de Janeiro, Ed. Saga.

FURTADO, Celso (1986b) - *Teoria e Política do Desenvolvimento Econômico*. São Paulo, Nova Cultural (2ª edição).

FURTADO, Celso (2003) *O Brasil do século XX: uma entrevista.* In: IBGE. Estatísticas do século XX. Rio de Janeiro: IBGE, pp. 11-24.

FURTADO, Celso (2004) *Receita para o Crescimento*, Jornal da Unicamp, set/out.

GADELHA, C.; MALDONADO, J. (2007) *A Indústria Farmacêutica no Contexto do Complexo Industrial e do Sistema de Inovação em Saúde*, RedeSist, Estudo Comparativo de Sistemas de Inovação no Brasil, Rússia, índia, China e África do Sul, Research Paper 15/07, Julho.

IBGE/PNAD (2006) - *Primeiras Análises, demografia, educação, trabalho, previdência, desigualdade de renda e pobreza*, IPEA, Brasília, setembro 2007. Disponível em <http://www.ibge.gov.br/home/estatistica/populacao/trabalhoerendimento/pnad2006 >

IPEADATA, IPEA- http://www.ipeadata.gov.br

KUPFER, David & ROCHA, Mario (2005) – Productividad y Heterogeneidad Estructural en la Industria Brasileña, in CIMOLI, Mario ed (2005) – Heterogeneidad

Estructural, Asimetrías Tecnológicas y Crecimiento en América Latina, CEPAL/BID, noviembre 2005.

LEMOS, C. e PALHANO, A. (2000) *Arranjo Produtivo Coureiro-Calçadista de Campina Grande/PB,* Arranjos e Sistemas Produtivos Locais e as Novas Políticas de Desenvolvimento Industrial e Tecnológico, Nota Técnica 22, mimeo.

LUNDVALL, B.-Å. (1985), Product Innovation and User–Producer Interaction, Aalborg: Aalborg University Press.

LUNDVALL, B.-Å. (1988), Innovation as an interactive process: from user–producer interaction to the National Innovation Systems, in G. DOSI, C. FREEMAN, R.R. NELSON, G. SILVERBERG and L. SOETE (eds), Technical Change and Economic Theory, London: Pinter Publishers.

LUNDVALL, B.-Å. (ed.) (1992), *National Innovation Systems: Towards a Theory of Innovation and Interactive Learning*, London: Pinter Publishers.

MEDEIROS, C. (2003) *Desenvolvimento Econômico e Estratégias de Redução da Pobreza e das Desigualdades no Brasil*, Ensaios FEE, Porto Alegre, v. 24, n. 2, p. 323-350.

MEDEIROS, C. (2004) Desenvolvimento Econômico, Heterogeneidade Estrutural e Distribuição de Renda no Brasil. III Conferência Internacional da Rede de Estudos sobre o Desenvolvimento Celso Furtado, IE, Rio de Janeiro, 4 a 6 de maio.

POCHMANN, M. (2006) *Indicadores de Pobreza e a Pobreza dos Indicadores*, CESIT, Carta Social, no. 4, maio/ago.

POCHMANN, M. (2007a) *Desenvolvimento e Processo de Exclusão Social: a experiência brasileira recente,* mimeo.

POCHMANN, M. (2007b) *Política Social na Periferia do Capitalismo: a situação recente no Brasil*, Ciência & Saúde Coletiva, 12(6):1477-1489, 2007.

POCHMANN, M. (2008) - *Progresso Técnico e Subdesenvolvimento,* apresentação no XX Fórum Nacional BRASIL "Um Novo Mundo nos Trópicos" 200 Anos de Independência Econômica e 20 Anos de Fórum Nacional, 26 a 30 de maio de 2008.

POCHMANN, M.; FAGNANI, E. (2006) *Apresentação*, SIT, Carta Social e do Trabalho, n, maio/ago.

POCHMANN, M.; WOHLERS, M. (2008) *Principais Características da Inovação na Indústria de Transformação no Brasil*, IPEA, Comunicado da Presidência, n. 5, Brasília, maio.

SALM, Cláudio – S*obre a Recente Queda da Desigualdade de Renda no Brasil: Uma Leitura Crítica*, IE-UFRJ, mimeo.

STORPER, M. (2000) *Lived effects of the contemporary economy: globalization, inequality and consumer society.* Public Culture, vol. 12, 2, pp. 375-409.

SUTZ, Judith; AROCENA, Rodrigo (2006), *Integrating Innovation Policies with Social Policies: A Strategy to Embed Science and Technology into Development Process*; IDRC Strategic Commissioned Paper, April.